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OBSERVATIONS ON FISHES AND OTHER BIOTA OF EAST LAGOON, GALVESTON ISLAND

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OBSERVATIONS ON FISHES AND OTHER BIOTA OF EAST LAGOON, GALVESTON ISLAND

By

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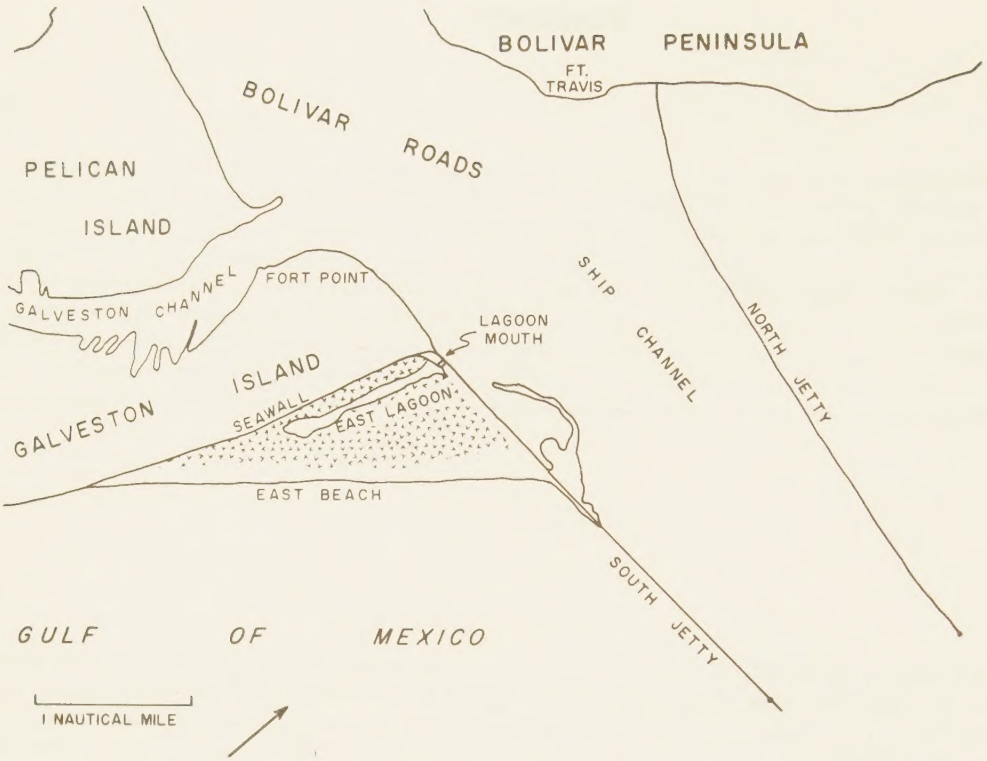

Figure 1.--East Lagoon, Galveston, Texas.

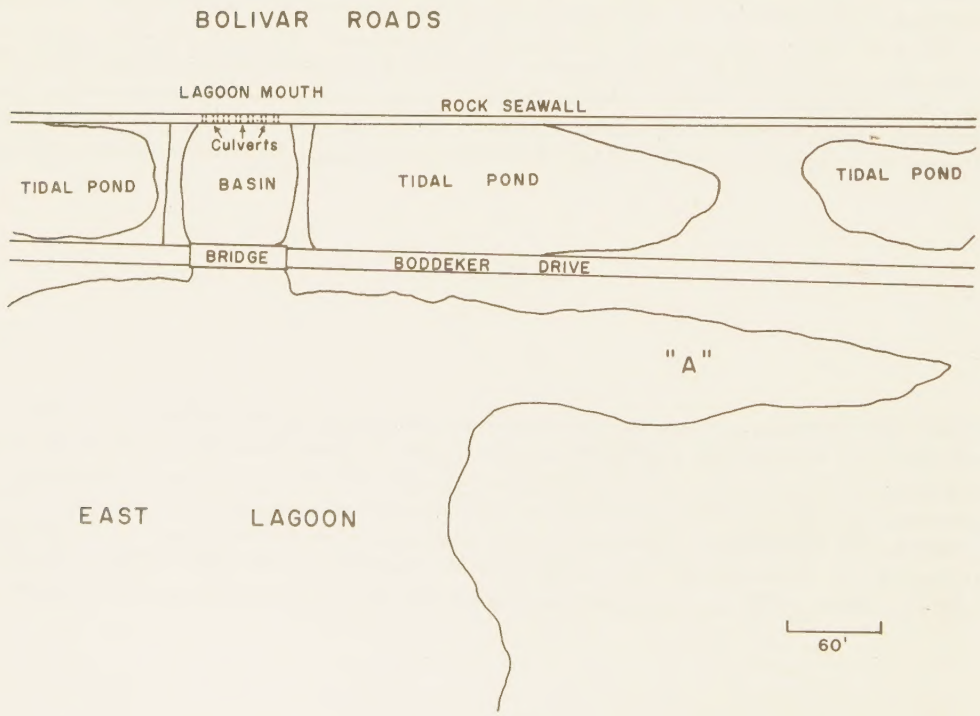

Figure 2.--Mouth of lagoon and adjacent area, showing location of plankton sets at culverts.

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ABSTRACT

From November 1953 to May 1958, collections of biological material by plankton net, cast net, and dip net were made in the vicinity of the mouth of East Lagoon, Galveston Island, with emphasis being placed on the seasonal occurrence and abundance of fishes. Results of these collections, coupled with visual observations, are presented and discussed. Thirty-five families of fishes were found to occur, dominated by the Clupeidae, Engraulidae, Sparidae, Sciaenidae, and Mugilidae. Concurrent water temperatures and salinities are presented in tabular form.

INTRODUCTION

The importance of estuaries, bays, and lagoons to many marine organisms, especially in their developmental stages, is clearly recognized. To add to the limited knowledge of one such area, biological collections over an extended period were made in the vicinity of the mouth of East Lagoon, a narrow, mile-long body of water located in the northeastern end of Galveston Island (fig. 1). This paper presents the seasonal distribution and abundance of its principal fauna as determined by these collections.

East Lagoon was formed by dredging operations during the construction of Galveston's sea wall in 1917-1919. For a number of years the lagoon's protected waters were used extensively for recreational purposes. However, as the only water exchange between the lagoon and Bolivar Roads was tidal seepage through the rock breakwater (fig. 2) and occasional storm tides, a stagnant condition slowly began to develop, especially at the head of the lagoon. To alleviate this condition, the U.S. Corps of Engineers installed seven concrete culverts in October 1953, connecting the lagoon directly with Bolivar Roads. The resulting tidal currents flowing through the culverts were usually strong enough to stream plankton nets, and periodic collections of biological material were made at this location (fig. 2). Field work began in November 1953 and continued through May 1958, averaging about one collection every 4 days.

COLLECTION AND TREATMENT OF SAMPLES

Plankton samples were obtained by streaming nets for a specified time, usually 15 minutes, in the tidal currents flowing in or out of the culverts at the mouth of the lagoon (fig. 3). Depth of water within 30 feet of the three central culverts in both the lagoon and channel was 3-4 feet at mean low water. To lighten the gear and to prevent the nets from sinking to the bottom in currents that often were as slow as one-fourth knot, silk or nylon bags were used as buckets, and net mouth-rings were fabricated from aluminum tubing.

The 408 plankton net sets made during the period of study are presented in table 1 according to their frequency by month and year. Although it was desirable to operate with identical gear throughout the course of field work, circumstances often necessitated the use of different nets, as follows:

Diameter	Mesh	Number of Sets
1/2-meter	#0000 nylon	5
1/2-meter	#1 nylon	247
1/2-meter	#10 nylon	110
12-inch	#0000 nylon	11
12-inch	#1 nylon	17
12-inch	#10 nylon	11
6-inch	#10 silk bolting cloth	7

Figure 3.--Setting plankton net at culverts, mouth of East Lagoon.

Thus the results are only quasi-quantitative, but do provide a measure of the occurrence and relative abundance of various planktonic forms from season to season and from year to year.

Table 1.--Plankton net sets

Month	1953	1954	1955	1956	1957	1958	Total
January		5	13	12	3	8	41
February		10	17	8	1	8	44
March		5	12	9	4	10	40
April		9	16	10	3	12	50
May		0	12	0	7	6	25
June		4	10	10	6		30
July		10	7	8	5		30
August		11	8	4	5		28
September		3	12	5	2		22
October		7	9	5	6		27
November	10	6	11	5	6		38
December	2	10	8	4	9		33
Total	12	80	135	80	57	44	408

While the net was fishing, a water sample for salinity determination was obtained, and the following observations were made: air[1] and water temperatures, current velocity,[1] tide conditions,[1] turbidity,[1] and direction and force of wind.[1]

In addition to the plankton sampling, the presence and abundance of fish in the immediate vicinity was noted by (1) visual observations, (2) use of a small-mesh dip net, (3) use of a cast net, (4) catches of anglers, and (5) material collected by beach-seining activities in a small cove in the northeast corner of the lagoon (fig. 2, "A"). Eight hauls were made in this location, seven in November 1955 and one on April 23, 1956, with a seine 50 feet in length, of $\frac{1}{2}$-inch stretch mesh.

Plankton samples were sorted in the laboratory. It was not possible, in the time allotted, to identify the relatively small numbers of fish eggs that occurred from time to time. Invertebrates were listed by major grouping (copepods, chaetognaths, etc.) and their abundance noted. Identification of fish specimens was determined at least to family; their abundance and stage of growth were recorded and subsamples preserved. With the start of a menhaden research program in November 1955, emphasis was placed upon the occurrence of this species in the study area.

PRESENTATION OF DATA

Although 35 families of fishes, representing approximately 70 species, were present, relatively few families and species dominated the collections. Occurring

[1]Data not used in this report.

most frequently were Clupeidae (herrings), Engraulidae (anchovies), Sparidae (porgies), Sciaenidae (croakers), and Mugilidae (mullets). These are included among the eight most abundant species found by Reid (1956) in his summer studies of East Bay, Texas. The occurrence and abundance of larval forms of the first four of these families in the plankton catches is presented for each month in tables 2 - 5, with accompanying discussion. Juveniles, never less than 25 mm. in total length, were the earliest life history stage of Mugilidae taken. As juvenile mullet are too agile to be captured easily by plankton nets, catches with this gear were not regarded as representative. Estimates of their abundance and occurrence were obtained by combining the catches of plankton nets, cast nets and dip nets, and visual observations. The remaining families and/or species are discussed in less detail. Family nomenclature and order of presentation follow that of Berg (1947). Alternate nomenclature still in common usage is given in parentheses.

Lengths of specimens possessing forked tails were measured from the tip of snout to caudal fork. Those with nonforked tails were measured from the tip of snout to the tip of the longest caudal ray.

Developmental stages of fishes referred to in this paper may be defined as follows:

Larva - organism between emergence from ovum to the point where adult characteristics begin to appear. In *B. patronus*, for example, deepening of the body and appearance of a lateral silvery sheen occurs when the larva reaches approximately 23 mm. in length. Hubbs (1943) separates larvae into "pro-larvae" (emergence from ova to absorption of yolk sac) and "post-larvae" (from absorption of yolk sac to transformation into juvenile). Most of the identified lagoon fish larvae would fall into this latter category.

Juvenile - organism whose morphological characteristics are essentially similar to that of the adult.

Young - young of the year; zero year-class.

Limitations on time precluded classifying many of the invertebrates into the lesser taxonomic groups. Because of the great variations in numbers of the invertebrates collected, they were recorded in seven categories of abundance, as follows:

No. per sample
0
1 - 50
51 - 100
101 - 500
500 - 1,500
1,500 - 10,000
10,000+

The four most abundant forms on a year-round basis are presented according to the percent occurrence of the abundance categories by month for the entire period of collection (see section on invertebrates, figs. 7 - 10). The order of presentation of invertebrates follows that of Pratt 1948.

Variations in the water temperature data are shown in figures 4 - 5. The temperature was determined by either immersing a thermometer directly into the water of the basin or into water dipped up in a plastic bucket. Temperatures

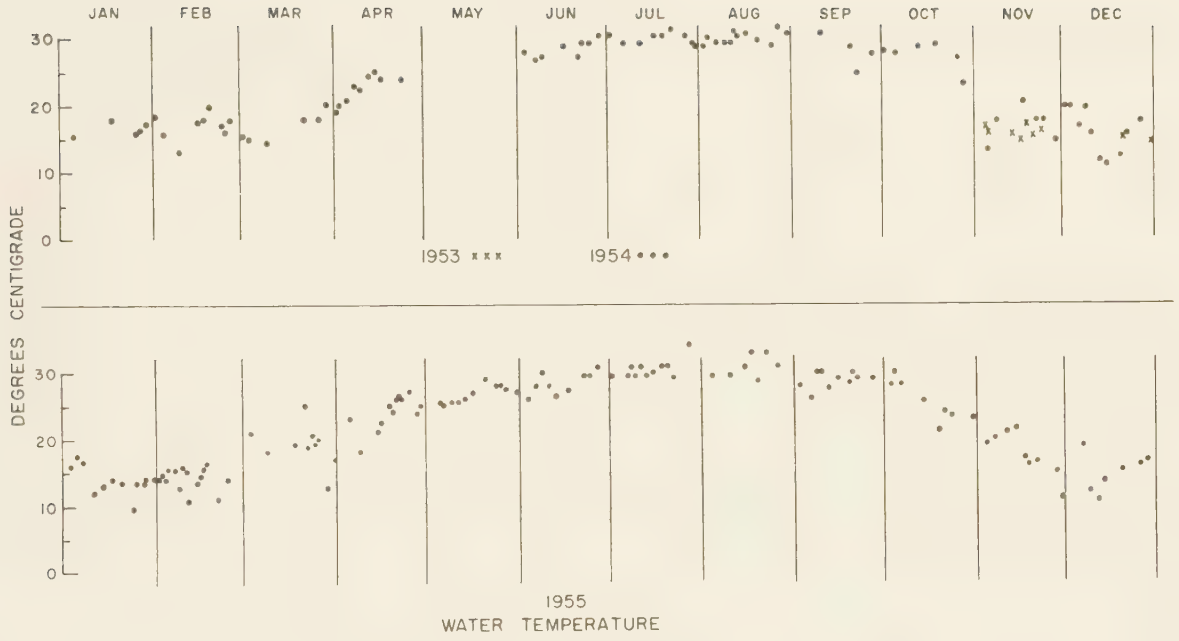

Figure 4.--Water temperatures at culverts (November 1953 - December 1955).

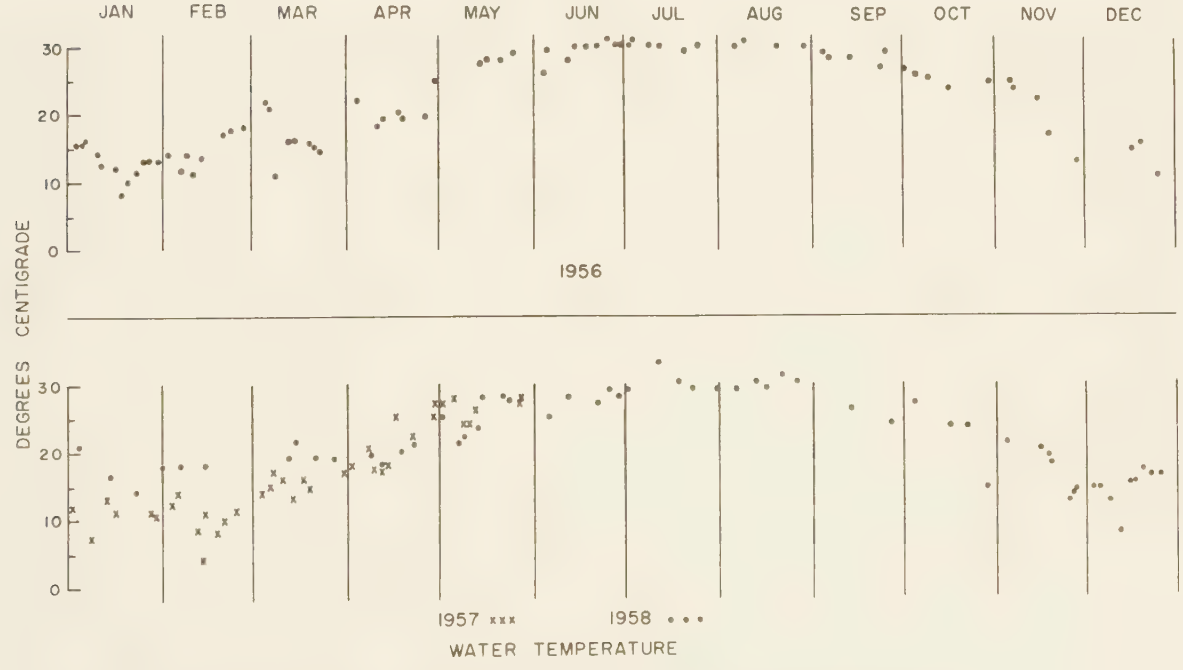

Figure 5.--Water temperatures at culverts (January 1955 - May 1958).

were obtained for 2 months in 1953 and for 5 months in 1958. Mean temperatures and range for each of the complete years of observations were as follows:

Year	Mean temp. °C.	Temp. range °C.	No. of observations
1954	22.5°	11.5° - 32.0°	87
1955	22.3°	9.3° - 34.5°	129
1956	21.4°	8.0° - 31.0°	80
1957	20.1°	7.5° - 33.0°	59

Variations in salinites are shown in figure 6. Water samples for their determinations were obtained by immersing 4-oz. glass prescription bottles just below the surface, rinsing thoroughly, refilling, and sealing caps with plastic electrician's tape. Determinations were made by the Mohr-Knudsen titration method. Except for the period June-November 1955, which was a prolonged dry spell, considerable variation occurred between successive observations. Salinities ranged from 4.5‰ on June 5, 1957, to 36.5‰ on August 19, 1955. As would be expected in the relatively shallow lagoon, changes in meteorological conditions were quickly reflected in salinities and water temperatures.

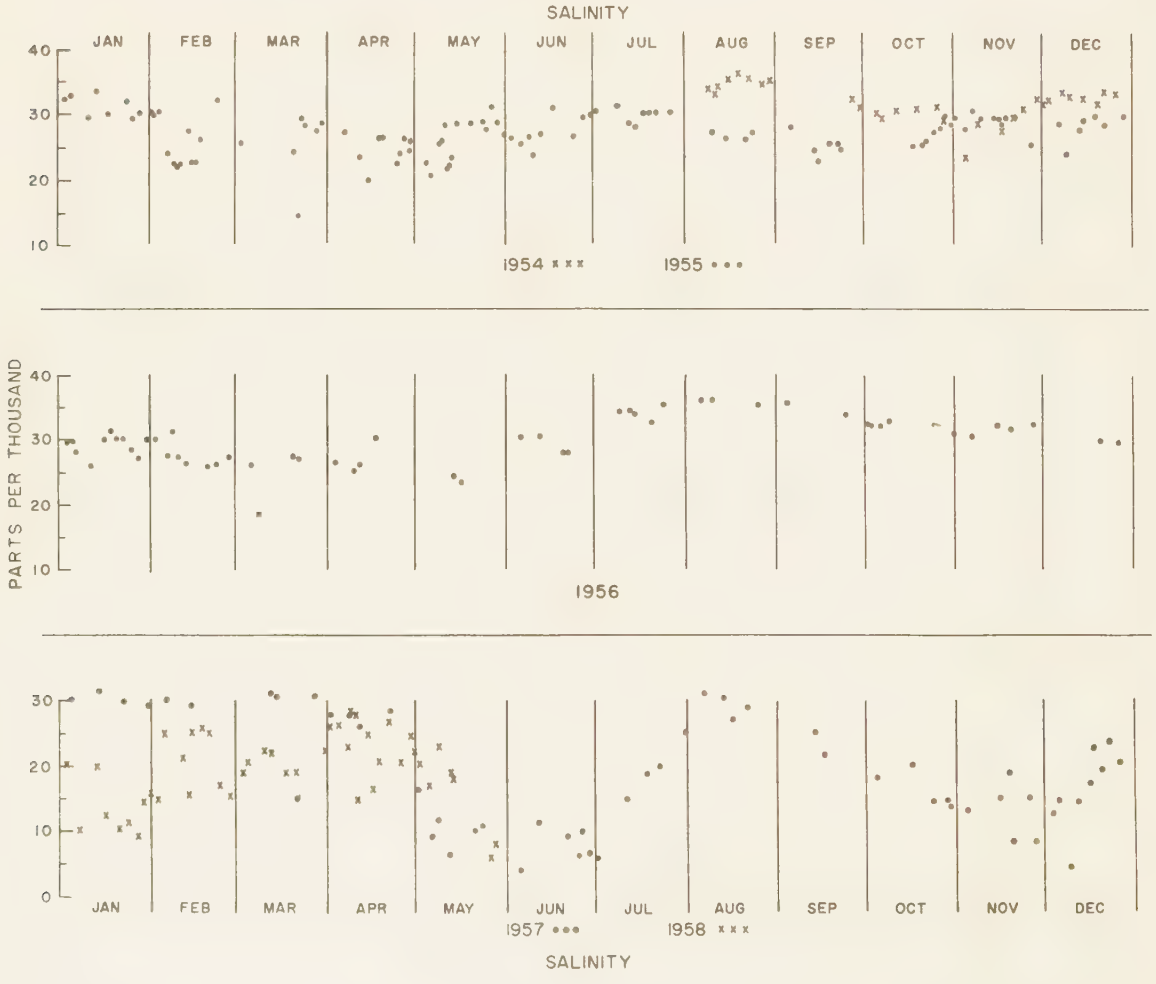

Figure 6.--Salinities of water samples at culverts (August 1954 - May 1958).

LEPIDOSTEIDAE (LEPISOSTEIDAE) — Gars

Lepisosteus spatula (Lacépède) — Alligator Gar

A single specimen, approximately 70 cm. in length, was observed in waters of the lagoon mouth near the culverts on May 14, 1958, ostensibly feeding on dense schools of juvenile menhaden.

ELOPIDAE — Tenpounders

Elops saurus Linnaeus — Tenpounder, Skipjack

Adult tenpounders were caught occasionally by anglers during summer and early autumn, but as would be expected of so active a fish, not even juveniles were taken by our collection methods. However, tenpounder larvae (leptocephali) from 41.0 to 28.0 cm. in length, or in early metamorphic stages (Gehringer 1959), were taken in numbers varying from one to several hundred, and occurred from early March to mid-April in 1954, from early March to mid-May in 1959 and 1957, throughout March and April in 1956, and from early April to mid-May in 1958. The initial seasonal appearance of these leptocephali agrees closely with Gehringer's findings, but their duration is evidently much less as he found some occurring in late October. It appears that spawning of *E. saurus* in local waters is limited to a 6- to 8-week period, beginning about the last week in February.

Leptocephali of the tenpounder were identified by raising specimens in aquaria to the easily recognizable juvenile stage. One such specimen lived for $2\frac{1}{2}$ years, and reached a fork-length of 25.0 cm. Another specimen, held for 13 months, attained a length of 29.0 cm. The difference in growth may be due to the fact that the former was held in a 25-gallon aquarium for 5 months before being transferred to a 75-gallon aquarium, while the latter spent its entire life in the larger tank.

CLUPEIDAE — Herrings

Harengula pensacolae Goode and Bean — Big-Eyed Sardine

Larvae of this species appeared in May 1956 but not until June in 1954, 1955, and 1957. Juveniles were present until mid-November in 1954 and 1956 but were not found after September in 1955 and 1957. Spawning is probably extensive as larvae were commonly taken as late as August. The big-eyed sardine is the most abundant clupeid in the area during late summer and early autumn, occurring in small, discrete schools of 20 to several hundred fish.

Opisthonema oglinum (Le Sueur) — Thread Herring

During the period of collecting, only one thread herring appeared in the catches. This specimen, a juvenile measuring 7.2 cm. in length, was taken in a plankton tow on December 9, 1957.

Brevoortia patronus Goode — Gulf Menhaden

Two species of menhaden are known to occur along the Texas coast, *B. patronus*, the Gulf menhaden, and *B. gunteri* Hildebrand, the fine-scale menhaden. Adults, young, and juveniles of these species can be separated readily by differences in

body shape, coloration, presence or absence of striations on the operculum, and by comparison of their scales.[2] No adult, young, or juvenile *B. gunteri* ever appeared in the lagoon collections, although adults and young were found from time to time in catches of commercial seiners along the Gulf beaches of Galveston Island during spring and summer months.

Adults and young of *B. patronus* were observed sporadically, chiefly on the channel side of the lagoon mouth. Many larval menhaden were taken in the collections. The larval stages of the two menhaden could not be separated, and it is possible that both species were represented. In attempts to rear larval menhaden to a size where species differentiation could be determined, specimens were held in aerated 30-gallon aquaria. Although they fed actively on tropical fish food, brine shrimp, and finely macerated fresh shrimp, and often lived for as long as 3 months, no increase in length or depth, or any change in other morphological characteristics was apparent. However, as only *B. patronus* juveniles and young were found in the vicinity, larval menhaden in the collections are considered as this species. Their occurrence and abundance throughout the study period are shown in table 2. The data indicate that spawning takes place from late October through April, probably offshore, with a peak in January. These findings agree closely with those of previous investigations of *B. patronus*.

Of special note was the occurrence of tremendous numbers of juvenile menhaden (30-38 mm.) on May 1, 1958. This concentration was maintained for several days despite almost continuous decimation by speckled trout, terns, gulls, and anglers seeking them for bait. Juveniles were observed and commonly taken by cast net and dip net throughout late spring and early summer.

Table 2.--Occurrence of B. patronus (larvae)

Month	Average number per set					
	1953	1954	1955	1956	1957	1958
January		3,679	77	671	21	189
February		701	332	1,228	108	359
March		558	234	511	141	114
April		111	16	226	140	37
May		-	1	-	0	1
June		0	0	0	0	
July		0	0	0	0	
August		0	0	0	0	
September		0	0	0	0	
October		0	0	0	0	
November	62	0	2	1	145	
December	43	103	251	40	271	

Dorosoma cepedianum (Le Sueur) Gizzard Shad

Three gizzard shad, measuring 11.5, 19.0, and 23.0 cm., were taken by seining operations in area "A" in November 1955. Two, 12.0 and 14.5 cm. in

[2] For the same size fish, scales of *B. patronus* are approximately three times as large in area as those of *B. gunteri*; they are square in shape in contrast to the rectangular-shaped scales of *B. gunteri*, and their ctenii are pointed, as contrasted to the blunter and shorter ctenii of the latter species.

length, were seined in the same location on April 23, 1956. As they are active fish and able to avoid the other types of collecting gear, it is possible that the gizzard shad is more numerous than indicated.

ENGRAULIDAE — Anchovies

Anchoa mitchilli diaphana (Cuvier and Valenciennes) — Bay Anchovy

The bay anchovy is a year-round inhabitant of the lagoon. It was either observed, caught by cast net or dip net, or appeared in plankton catches in every month, and was second to the pinfish in abundance. With the exception of several large schools of adults observed on August 6, 1956, very few anchovies were noted during late summer and early autumn.

Table 3 presents the occurrence of bay anchovies, larvae through adult, in the plankton net catches. Observations and other collecting methods revealed that adults and young were most abundant from April through June.

Anchovies usually are not regarded as predators, but both young and adults frequently were observed feeding voraciously on larval Clupeidae, Sciaenidae, Sparidae, Penaeidae, and even larvae of their own species.

Anchoa hepsetus (Linnaeus) — Striped Anchovy

A total of six adult striped anchovies was taken on four occasions. One specimen, 7.2 cm. in length, and three that measured 8.5, 8.7, and 9.5 cm., were found in the catches of plankton tows made on March 3, 1955, and January 11, 1956, respectively. A 9.6-centimeter specimen was taken by cast net on September 20, 1955. The largest striped anchovy collected, 11.5 cm. in length, was caught on hook and line by the senior author on November 8, 1957.

Table 3.--Occurrence of Anchoa mitchilli diaphana

	Average number per set					
Month	1953	1954	1955	1956	1957	1958
January		17	8	62	1	2
February		5	9	14	5	2
March		9	64	56	0	0
April		1	0	28	2	19
May		-	18	-	1	12
June		29	1	2	1	
July		3	0	4	0	
August		1	0	1	0	
September		0	0	0	0	
October		28	1	0	10	
November	3	51	221	9	10	
December	6	47	9	9	8	

SYNODIDAE (SYNODONTIDAE) — Lizardfishes

Synodus foetens (Linnaeus) — Lizardfish

Thirty lizardfish were taken in the course of collecting activities. Five were larvae (plankton sets on April 16, 1954; March 24, 1955; May 14, 1956; and May 23, 1957), averaging 6.0 cm. fork-length. One adult, 28.0 cm. in length, was caught by an angler on October 19, 1954. The remainder, varying in length from 17.5 to 27.0 cm., were taken in a single seine haul in the northeast corner of the lagoon on November 23, 1955.

One of the larvae (6.2 cm.) placed in a 30-gallon aquarium, fed voraciously on live larval Clupeidae, Sparidae, Sciaenidae, and other small fish. Its manner of feeding was extremely interesting and worthy of note. The fish would lie buried in the sand at the bottom of the aquarium with just its eyes protruding. When a larval menhaden, for example, was introduced into the tank, the lizardfish would wait until the menhaden was about 10 inches away. Then, with lightning-like rapidity, it would dart from its cover, seize its prey, and re-bury itself. Frequently, the only visible part of the process would be two successive clouds of sand, separated by a swirl of water. At its time of death, after 2 months of captivity, the lizardfish had attained a length of 15.5 cm.

ARIIDAE — Marine Catfishes

Bagre marina (Mitçhill) — Gafftopsail Catfish

Gafftopsail catfish were caught infrequently by anglers fishing from the rocks bordering the channel side of the mouth of the lagoon. Such catches were confined to the warmer months, principally in late summer. Although juveniles, 4-5 cm. in length, appeared in large numbers in seine hauls along the Gulf beaches in early fall, none were ever taken or observed in the lagoon.

Galeichthys felis (Linnaeus) — Hardhead, Sea Catfish

This small species of catfish was commonly taken by angling in the study area from May to October. Due to their size (average weight less than $\frac{1}{2}$ pound) and their ability to inflict a painful wound with dorsal and pectoral spines, hardheads are regarded as undesirable pests by the majority of anglers. As with the "gafftop", no juveniles ever appeared in our collections.

MURAENIDAE — Morays

Gymnothorax ocellatus Agassiz — Ocellated Moray

The only occurrence of this species during the period was a 34.0-centimeter specimen taken by hook and line on October 6, 1955. However, anglers have reported catching small morays in the area, and they are probably more common than indicated by the single capture.

ECHELIDAE — Worm Eels

Myrophis punctatus Lütken — Speckled Worm Eel

One to two leptocephali of this little-known eel were present in plankton collections made during the months of February and December in 1954, February in 1955 and 1956, and December in 1957. More than 100 leptocephali were taken in

a single set on January 16, 35 leptocephali and 6 elvers in a set on January 21, 1958. Both leptocephali and elvers appeared in decreasing numbers in most sets until the 7th of March. Identification was made by raising leptocephali to the elver stage in an aquarium.

OPHICHTHYIDAE — Snake Eels

Mystriophis mordax (Poey) — Spotted Snake Eel

During the month of October 1955, three large eels were brought to the laboratory for identification. These fish, ranging in length from 78.0 to 105.5 cm., proved to be spotted snake eels. All were taken by hook and line in the immediate vicinity of South Jetty, approximately 3/4 of a mile from the lagoon. On October 28, 1955, a 75.0-centimeter specimen was caught in the basin by an angler.

With their imposing array of teeth, spotted snake eels rival morays in viciousness of appearance. Evidently their occurrence in Galveston waters is very sporadic, as there has been only one incidence of capture reported other than those of October 1955. Following the publication of an article on the species in a local newspaper, illustrated with a picture of the largest specimen, a sportfisherman reported that he had caught a 4-foot eel "some years ago" off the South Jetty. From his detailed description, the fish in question was undoubtedly a spotted snake eel.

BELONIDAE — Needlefishes

Strongylura marina (Walbaum) — Needlefish, Silver Gar, Billfish

Needlefish, in small schools of 5 to 10 fish, were observed on many occasions "patrolling" the waters of the basin and channel adjacent to the culverts, usually when there was an abundance of larval or juvenile menhaden, or other small, schooling fish. The average size was approximately 25.0 cm. One 44.5-centimeter specimen, captured on February 19, 1954, was a nearly riped female, which indicates that spawning of the species in local waters probably occurs in early spring.

HEMIRHAMPHIDAE — Halfbeaks

Hyporhamphus unifasciatus (Ranzani) — Common Halfbeak

Juvenile and young halfbeaks were observed occasionally in the vicinity of the culverts from June to mid-October. They were most abundant throughout June and July, and like needlefish, occurred in groups of 5 to 10 fish. Except for a single specimen measuring 15 cm., dip-netted on October 1, 1954, the halfbeaks captured or seen were between 3 and 4 cm. in length.

SYNGNATHIDAE — Pipefishes and Seahorses

Syngnathus sp. — Pipefish

Single, immature pipefish, 2-6 cm. in length, were taken by plankton net on four different occasions, all in early spring. Several species are known to occur in inshore waters of Texas, the most common being the southern pipefish, *S. scovelli* (Evermann and Kendall), but as identification of these very young specimens was not possible, they are listed as *Syngnathus* sp.

Like their close relatives the seahorses, pipefish make an excellent aquarium fish if suitable live food is provided.

CYPRINODONTIDAE — Killifishes

Killifishes, represented almost exclusively by the Gulf killifish, *Fundulus grandis* Baird and Girard, the striped or sharpnosed killifish, *Fundulus similis* (Baird and Girard), and the sheepshead minnow, *Cyprinodon variegatus variegatus* Lacépède, were found throughout the year in the study area. Commonly referred to as "mudfish" by anglers, they were used frequently as bait for flounders, redfish, and trout. Another species, found occasionally at all seasons, was the diamond killifish, *Adinia xenica* Girard.

POECILIIDAE — Top Minnows

Mollienisia latipinna Le Sueur — Sailfin Molly, Common Sailfin

Sailfins were seldom observed in the vicinity of the lagoon mouth, but were numerous and sometimes abundant in waters at the head of the lagoon, particularly along the shores of a drainage canal emptying into the area. Their occurrence was limited to the warmer months.

Apparently, the sailfins are a comparatively slow-growing species. A pair of the species, held in an aerated and filtered 30-gallon aquarium, produced a total of 12 young on two different occasions. The young fed greedily on brine shrimp, commercially prepared tropical fish food, and bits of shrimp, but at the end of 13 weeks were considerably less than half the size of their parents.

MUGILIDAE — Mullets

Mugil cephalus Linnaeus — Striped Mullet, Jumping Mullet

The striped mullet is found throughout the year in East Lagoon and is more numerous in the spring, summer, and fall. It is third in abundance of indigenous fish species. The average size of mullet in our collections was about 12 cm., but larger specimens up to 30 cm. in length, were taken and observed frequently. Highly valued as a food fish along other parts of the Gulf coast, the striped mullet, for some inexplicable reason, is used almost exclusively for bait in Texas.

Each year during the study, dense schools of large adults (20-30 cm.) were observed around the lagoon mouth in mid-autumn, usually coinciding with a strong, ebbing current. Examination of captured specimens revealed many with what appeared to be ripe gonads. However, several attempts to hatch larvae by mixing extruded milt and ova were unsuccessful. Further, no larvae have ever been found in the plankton collections, the smallest *M. cephalus* first appearing as 25-30 mm. juveniles, possibly 3-4 weeks old, indicating that actual spawning takes place elsewhere, doubtless in deeper offshore waters (Arnold and Thompson 1958).

Juveniles first appeared in the different years, as follows:

1953 - early December
1954 - late November
1955 - mid-November
1956 - mid-November
1957 - late November

Juveniles of similar size continued to appear until mid-February, indicating that the spawning period of the striped mullet in waters off the Texas coast takes place from mid-October to about the latter part of January.

Although white or silver mullet, *M. curema* Cuvier and Valenciennes, are known to occur in Texas waters, none were taken during the period of study. It was not possible to examine each of the thousands of juvenile mullet collected, but all that were examined proved to be *M. cephalus*, and lagoon specimens, therefore, are considered to be this species.

ATHERINIDAE — Silversides

The rough silverside, *Membras vagrans vagrans* (Goode and Bean), and tide-water silverside, *Menidia beryllina pensacolae* (Goode and Bean), are both represented in the collections. Scale counts and examination of scales showed that the former were by far the dominant species. As no differentiation of species was determined for many of the collections, they were not considered separately.

Silversides are year-round inhabitants of the area, appearing in small, discrete schools of 50 to several hundred fish. They occurred in greatest abundance from May through July, and in small numbers during the months of December and January.

POLYNEMIDAE — Threadfins

Polydactylus octonemus (Girard) — Threadfin, Eight-Fingered Threadfin

Approximately 500 threadfins, 7.5 to 9.0 cm. in length, were taken in a single beach-seine haul in area "A" on April 23, 1956. A few, in the same size category, were dip-netted around the lagoon mouth earlier in the month. Except for a single 7.0-centimeter specimen dip-netted in October 1955, these are the only capture records of the species within the defined area.

The threadfin is undoubtedly more abundant than indicated by these records of capture, for they are often taken in large numbers by beach seiners and small shrimp trawlers in Bolivar Roads.

POMATOMIDAE — Bluefishes

Pomatomus saltatrix (Linnaeus) — Bluefish

Bluefish occurred irregularly around the mouth of the lagoon during late spring and summer. Most were in the size category commonly referred to as "snapper blues", that is, from 12.4 to 20.0 cm. The smallest specimen taken measured 5.1 cm. As is characteristic of the species, bluefish revealed their presence by their frenzied pursuit of smaller fishes, frequently breaking water in the process.

CARANGIDAE — Jacks

Caranx hippos (Linnaeus) — Common Jack

Fifteen juveniles, from 3.4 to 4.5 cm. in length, dip-netted July 8, 1954, one juvenile of 3.5 cm., dip-netted July 3, 1956, and two juveniles 3.6 and 4.0 cm.,

dip-netted from a school of 10-12 fish on July 18, 1957, are the only records of captured specimens of the species. However, large schools of adults were observed occasionally during the late summer and early fall months in Bolivar Roads, 50-75 yards from the culverts.

Chloroscombrus chrysurus (Linnaeus) Bumper

Bumpers were recorded on three occasions; a single juvenile on August 20, 1954, a large school of juveniles on July 1, 1957, and a small school of young on October 23, 1957. Captured specimens ranged in length from 5.0 to 11.0 cm.

Selene vomer (Linnaeus) Lookdown

A single specimen, 12.7 cm. in length, was taken in a seine haul on November 18, 1955, in area "A".

Trachinotus carolinus (Linnaeus) Common Pompano

Juvenile and young pompano, varying in length from 1.0 to 8.8 cm., were taken from mid-June through July in 1954, 1956, and 1957, and from July through September in 1955.

During the collecting period a dozen or so juvenile pompano, 2-4 cm. in length, were placed in laboratory aquaria, usually two or three at a time. These specimens seemed to be continually in motion, swimming back and forth along the sides of the tank, just below the surface. They fed aggressively and preferred bits of shrimp, but would often chase and devour larval fish. Observations of their feeding habits revealed one interesting fact. On each occasion when they were not fed at least once a day, the pompano gradually became emaciated and died in 3 or 4 days, even though they seemed to resume feeding after such a lapse. This might be explained by their seemingly high rate of metabolism, and the possibility of serious systematic damage through even a temporary lack of food.

Oligoplites saurus (Bloch and Schneider) Leatherjacket

Leatherjackets first appeared in the vicinity of the culvert as 3.0- to 4.0-centimeter juveniles in July, usually in small groups of 5-10 fish, and were present sporadically through mid-November. At this time they averaged 14.0 cm., and often occurred in schools of approximately 100 fish, feeding actively on larval menhaden.

CORYPHAENIDAE Dolphins

Coryphaena hippurus Linnaeus Dolphin, Dorado

What is undoubtedly the most unusual specimen taken during the collecting period was dip-netted on the final day of the project, May 27, 1958. A small "different-looking" fish, observed swimming slowly near the surface close to the culvert, proved to be a larval dolphin, 2.5 cm. in length. The fish was very lethargic and died within several hours. As dolphins are primarily a pelagic fish of the open sea, the low salinity (8.8‰) of the lagoon at the time of capture might have been responsible for its poor condition.

Two species of dolphin are known from the Gulf of Mexico, *C. hippurus* Linnaeus and *C. equiselis* Linnaeus. The lagoon specimen was identified on the basis of criteria given by Gibbs and Collette (1959), namely, by the presence of vertical bands, the barred appearance of the dorsal fin, and dorsal ray count.

LUTJANIDAE — Snappers

Lutjanus synagris (Linnaeus) — Spot Snapper, Lane Snapper

The spot snapper was the only representative of this family observed in the area. They were taken occasionally by anglers during the fall months and varied in length from 12 to 17 cm.

LIOGNATHIDAE (GERRIDAE) — Mojarras

Eucinostomus sp.

The mojarras that occurred in the study area probably were comprised of the common mojarra, *E. gula* (Cuvier and Valenciennes). They were observed only during the warmer months and first appeared each year as larvae approximately 18 mm. in length. The duration of their stay in waters around the lagoon mouth for the different years was as follows:

1954	June 7	to November 24
1955	July 15	to November 4
1956	July 3	to November 13
1957	August 6	to October 28

Larval mojarras could be readily identified by the conspicuous black-tipped dorsal. As juveniles (25-40 mm.), they were often observed in discrete, motionless schools, all in the same horizontal plane, just above the surfaces of flat rocks near or on the bottom of the tidal basin. Easily captured by cast net, they were used frequently as live bait for flounder, trout, and redfish.

Adults never were observed before the latter part of August, and varied greatly in daily abundance until their disappearance in November. One interesting observation was their suspicion of a baited hook. Although they would dart forward quickly to snap up bits of cut bait used as chum, they would ignore the same type of bait when attached to a hook and line.

Their silvery appearance, coupled with distinctive feeding and swimming habits, makes the mojarra a colorful and interesting fish for marine aquaria enthusiasts.

POMADASYIDAE (HAEMULIDAE) — Grunts

Orthopristis chrysopterus (Linnaeus) — Pigfish

On April 12, 1956, anglers were observed catching numbers of pigfish around the lagoon mouth. They were nearly uniform in size, 16-18 cm., and evidently were from a school that had strayed into the area, for this was the only record of their capture.

SCIAENIDAE — Croakers

Sciaenid larvae appeared in the plankton net collections as shown in table 4. These were almost completely dominated by four species, namely: the croaker, *Micropogon undulatus* (Linnaeus); the spot, *Leiostomus xanthurus* Lacépède; the redfish

or red drum, *Sciaenops ocellata* (Linnaeus); and the black drum, *Pogonias cromis* (Linnaeus). Other species that occurred sporadically included the silver perch, *Bairdiella chrysura* (Lacépède); the speckled or spotted trout, *Cynoscion nebulosus* (Cuvier and Valenciennes); the sand trout, *C. arenarius* Ginsburg; and the banded croaker, *Larimus fasciatus* Holbrook. Identifications were made by rearing larvae to recognizable stages in aquaria.

Collection data indicate that spawning of most Sciaenidae in East Lagoon takes place from late fall to mid-spring. An exception is the occurrence of larvae in June 1954 that were probably sand trout.

Adult sciaenids furnish anglers with an abundance of sport-fishing activity throughout the year in and around the lagoon mouth. Most sought after are the speckled trout (spring, summer, and fall), the redfish (all year), and the croaker (spring and fall). Trout weighing 8 to 11 pounds have been caught in the area, while redfish over 15 pounds in weight have been taken from time to time.

Table 4.--Occurrence of Sciaenidae (larvae)

	Average number per set					
Month	1953	1954	1955	1956	1957	1958
January		16	94	58	1	176
February		83	364	24	25	477
March		789	39	31	6	85
April		0	3	2	3	2
May		--	0	--	0	0
June		37	0	0	0	
July		0	0	0	0	
August		0	0	0	0	
September		0	0	0	0	
October		1	0	1	1	
November	3	1	1	1	0	
December	21	4	1	2	6	

SPARIDAE — Porgies

Lagodon rhomboides (Linnaeus) — Pinfish, Pin Perch

The pinfish is the most abundant of any fish species found in the study area. Scorned by experienced fishermen because of its relatively small size (averages 12.0 cm.) and its bait-robbing ability, it nevertheless furnishes sport to many anglers. Throughout the year three out of four fish taken by hook and line are this prolific and aggressive porgy.

From the occurrence of larval Sparidae, which, with few exceptions, were 100 percent *L. rhomboides*, it may be concluded that spawning takes place from late autumn to late spring with a definite peak in February (table 5). No difficulties were experienced in rearing larvae for identification purposes.

Table 5.--Occurrence of Sparidae (larvae)

Average number per set

Month	1953	1954	1955	1956	1957	1958
January		7	121	64	50	42
February		830	1067	759	3	114
March		372	16	61	13	58
April		19	1	1	110	1
May		-	1	-	0	0
June		7	1	0	0	
July		0	0	0	0	
August		0	0	0	0	
September		0	0	0	0	
October		1	0	0	0	
November	0	0	0	1	1	
December	0	43	18	5	49	

Archosargus probatocephalus (Walbaum) Sheepshead

Sheepshead occurred on only one occasion, May 1, 1957, when 10 larvae, 6-11 mm. in length, were taken by dip net. Observations of angling activities and discussions with fishermen, however, revealed that this species is a perennial inhabitant of the area. Their cautious method of taking a bait requires considerable angling skill for success. Sheepshead are seldom taken by the fisherman who is after "anything that comes along", but rather by those with special bait, gear, and extreme patience. Although sheepshead attain a weight of approximately 20 pounds in some areas, those taken around the lagoon mouth seldom exceeded 5 pounds in weight, with the average nearer 1-2 pounds.

Gonad examination indicated that spawning takes place in late spring, and undoubtedly some of the Sparidae shown in table 5 included those of the sheepshead.

EPHIPPIDAE

Spadefishes

Chaetodipterus faber (Broussenet) Spadefish, Angel Fish (Texas)

Spadefish, weighing from one-half to approximately 3 pounds, commonly were caught by anglers around the lagoon mouth from May through November, and were most abundant during the months of June and October. A few were caught in March, April, and December, but none were observed being taken in January or February. However, fishing pressure is at an extremely low ebb in the area during cold weather, and the presence of hundreds of dead spadefish (1-3 pounds) along the shores of the lagoon following prolonged cold spells in January in 1951 and 1958, strongly indicates that the species is a year-round inhabitant of the lagoon.

Juveniles, from 1 to 3 cm. in length, were observed from mid-May to early July. They occurred singly, never in groups or schools, except when three or four could be seen congregated around various types of flotsam.

BLENNIIDAE — Blennies

Labrisomus nuchipinnus (Quoy and Gaimad) — Hairy Blenny

Juvenile and young of the hairy blenny were taken infrequently by dip net throughout the period, but were observed on numerous occasions, principally during the spring and summer months, and are undoubtedly year-round inhabitants of the lagoon. Captured specimens varied from 3 to 8 cm. in length. Although not taken in the study area, a specimen measuring 18.5 cm., caught on rod and reel from the South Jetty, seems worthy of note due to its extremely large size.

TRICHIURIDAE — Cutlass Fishes

Trichiurus lepturus Linnaeus — Cutlass Fish, Silver Eel (Texas)

This very active fish never was taken by our collecting gear. It occurred in large numbers within the area, chiefly during the warmer months, and was most abundant throughout late spring and autumn. Cutlass fish are caught frequently by anglers and are thoroughly detested as aggressive bait-robbers.

The average observed size was approximately 40.0 cm. Much larger individuals were noted on numerous occasions, and one, taken on rod and reel by the senior author, measured 86.0 cm.

Cutlass fish are extremely predaceous, and frequently were observed decimating schools of small fish. Considering these activities and its abundance, the cutlass fish unquestionably plays an important role in the ecology of the lagoon.

ELEOTRIDAE — Sleepers

Dormitator maculatus (Bloch) — Fat Sleeper

This colorful fish suddenly appeared in large numbers in the waters of the lagoon mouth on October 16, 1957. They were easily captured with a dip net or cast net, and for approximately a week, were the favorite bait used by flounder fishermen. However, they rapidly decreased in abundance, and by the end of the month could not be found anywhere in the vicinity. Evidently the heavy rainfall that deluged the watersheds of the Trinity and San Jacinto Rivers for the first 2 weeks of the month, and which resulted in the worst flood conditions in years, flushed many freshwater inhabitants out of their normal habitat into bayous and lagoons of more saline waters.

The sleepers varied in length from about 5 to 15 cm. Five specimens, averaging 10.0 cm. in length, were placed in a 70-gallon aquarium. They sought cover immediately, and in the 2 years of captivity emerged from "hiding" only to feed.

GOBIIDAE — Gobies

Gobies observed and occasionally taken included young and adults of the lyre goby, *Evorthodus lyricus* (Girard); the sharptailed goby, *Gobionellus hastatus* Girard; and the Texas goby, *Gobiosoma molestum* Girard.

TRIGLIDAE — Sea Robins

Prionotus tribulus (Cuvier) — Southern Sea Robin

Two juveniles, 2.5 cm. in length, were taken in a seine haul in area "A" on November 4, 1955. Both specimens were placed in a 30-gallon aquarium. One died within a few days; the other lived for nearly 5 months. At time of death it had attained a length of 16.0 cm. During captivity it became quite tame and could be fed by hand.

PLEURONECTIDAE — Flounders

Paralichthys lethostigma Jordan and Gilbert — Southern Flounder

Adult flounders were found in the study area throughout the year. They occurred in greatest abundance from October through November during a migration that is known locally as the "fall run". Whether this migration is from the bays, bayous, and lagoons seaward, or vice versa, is unknown. The presence of ripe gonads in specimens captured during this period indicates that the migration may be linked with spawning activities.

Juveniles, varying from 1.8 to 3.4 cm. in length, appeared occasionally in plankton net catches made in February (four specimens), March (six specimens), April (four specimens), and May (three specimens). One juvenile, 10.2 cm. in length, was dip-netted on September 2, 1955.

TETRODONTIDAE (TETRAODONTIDAE) — Swellfishes

Sphaeroides sp. — Swellfish, Puffer

A total of six juvenile swellfish were taken over the period of collections, four in a single seine haul in area "A" on December 6, 1955. Unfortunately, positive identifications were not made, and as three species of swellfish are known to occur along the Texas coast, namely: *S. spengleri* (Bloch), *S. nephelus* (Goode and Bean), and *S. marmoratus* (Ranzani), the lagoon specimens are given only to genus.

GOBIESOCIDAE — Clingfishes

Gobiesox strumosus Cope — Clingfish

Juvenile and young clingfish were observed on numerous occasions, but due to their habit of clinging tenaciously to submerged rocks, usually in hard-to-get-at places, only 20 specimens were taken. Two larvae were found in a plankton set made on April 16, 1954; the rest, varying in length from 2.0 to 3.5 cm., were dip-netted during the months of April and May.

Several specimens lived for a long as 5 months in an aquarium and became very tame, taking food from one's fingers.

BATRACHOIDIDAE — Toadfishes

Opsanus beta Goode and Bean — Toadfish, Oyster Dog

Strictly bottom inhabitants, toadfishes never appeared in our collections but were caught frequently by anglers in the warmer months. Because of their ugly appearance, slimy skin, their ability to inflict a painful wound with teeth or spines, and a tendency to swallow hook and line, they are regarded as pests, even more so than silver eels or hardhead catfish.

VERTEBRATES OTHER THAN FISHES

APPENDICULARIIDAE — Appendicularians

Appendicularians occurred in small numbers (1-60 specimens) in seven of the plankton samples. Because of the transparency and size (9-10 mm.), this pelagic tunicate occasionally may have been overlooked and may be more abundant than is indicated by the catch records.

CHELONIIDAE — Sea Turtles

Caretta caretta — Atlantic Loggerhead Turtle

On August 17, 1957, the senior author noticed a turtle swimming in the basin near the culverts. It seemed unconcerned by the excitement and commotion that its presence caused among a large gathering of spectators and swam close to shore where it was easily dip-netted. The turtle, identified as a young loggerhead, measured 36.5 cm. in shell length and was the only turtle captured within the area.

PHYTOPLANKTON

Various phytoplankters, usually in relatively small numbers, were observed in most of the catches. Occasionally, blooms of diatoms and blue-green algae *(Trichodesmium)* dominated the samples, the former numerically, the latter both in numbers and in volume, often forming a dense matrix. Diatoms were especially abundant in April, October, and November 1955, and in March 1956. In all instances, diatom abundance occurred in late fall, winter, and early spring. No pattern was apparent in the seasonal occurrence or abundance of blue-green algae. Extremely heavy blooms were observed in March and May 1955.

INVERTEBRATES

PROTOZOA

DINOFLAGELLIDA

A number of species of dinoflagellates are known to be present in East Lagoon waters, but only one, *Noctiluca scintillans* (Macartney), was noted in our collections. It occurred sporadically, occasionally in blooms that persisted for several weeks. One such bloom was observed in January 1955, lasting from the 3rd to the 28th. In 3 out of 13 samples obtained during the month, *Noctiluca* formed a dense, cohesive matrix. A similar instance of exceptional abundance occurred March 7-19, 1958. Like the diatoms, this dinoflagellate was found in large numbers only during late fall, winter, and early spring.

COELENTERATA — Polyps

Various types of coelenterates, mostly in the medusa stage, were of common occurrence throughout the entire period of study, frequently comprising 95 percent

of the catch by volume. Siphonophores were found only from October to mid-April and never appeared in large numbers. A few very small sea-anemones occurred in catches made on four occasions, June 3 and October 16, 1954; November 3, 1955; and December 12, 1957.

CTENOPHORA — Comb Jellies

Comb jellies of the order Beroida commonly occurred in the plankton catches in moderate abundance except during the months of July, August, and September when very few were observed. They were present in exceptionally large numbers on June 26, 1958.

ASCHELMINTHES — Rotifers

Rotifers were observed on three occasions, April 14 and May 19, 1954; and June 24, 1955, and then only in relatively small numbers (25-60 per sample). Attempts to hold them in aquaria were unsuccessful, all disappearing overnight.

CHAETOGNATHA — Arrow Worms

Arrow worms, or sagitta, were of common occurrence. Their relative abundance throughout the period is presented in figure 7. On three occasions they were exceptionally abundant, namely: March 31 and May 11, 1955; and November 28, 1956. They were least abundant throughout the summer and early fall (June through October).

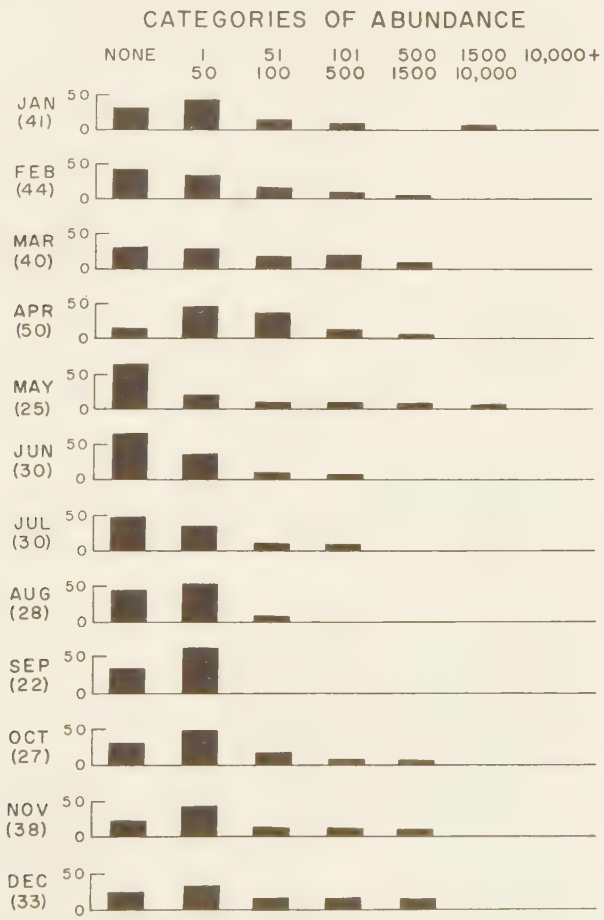

Figure 7.--Percentage occurence of arrow works in categories of abundance (Nov. 1953 - May 1958).

ANNELIDA — Segmented Worms

Tiny polychaete worms (3-6 mm.) occurred sporadically and usually in very small numbers (less than 10) throughout the period. However, several thousand appeared in the catch made on April 20, 1955, and continued to be present in gradually diminishing numbers until mid-May.

One unusual form, *Tomopteris* sp., was found on two occasions, December 15, 1954, and December 12, 1955. Both specimens were approximately 15 mm. in length and were apparently approaching spawning condition with 100-140 ova visible in the body cavity.

ARTHROPODA

EUCOPEPODA — Copepods

With few exceptions, copepods, chiefly of the Calanoida, were present in every tow in each month and were the dominant zooplankters on a year-round basis. Figure 8 shows the variations in abundance of this crustacean during the period of study.

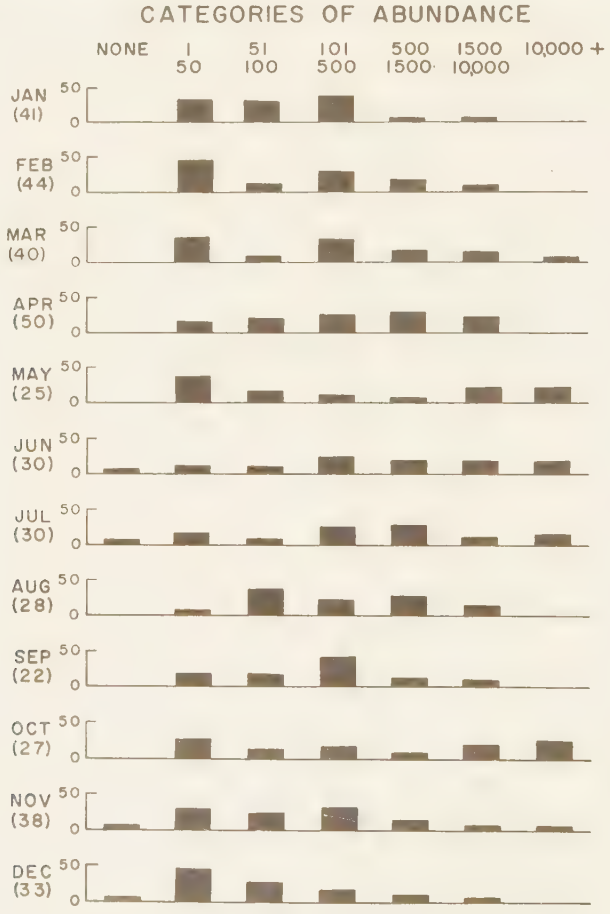

Figure 8.--Percentage occurrence of copepods in categories of abundance (November 1953 - May 1958).

Caligoid copepods were observed from time to time in the collections, usually as individual specimens. When placed in an aquarium, they would attach themselves immediately and permanently to the first available post-larval fish in the tank.

THORACICA

Barnacles

The occurrence of barnacles in nauplii and cyprid stages is given in figure 9. The latter averaged less than 0.5 percent of the catch composition of the two stages. Except for 1957 and 1958, which seemed to be poor years as far as barnacle productivity was concerned, the period of greatest abundance was January through April, with a peak of production in February.

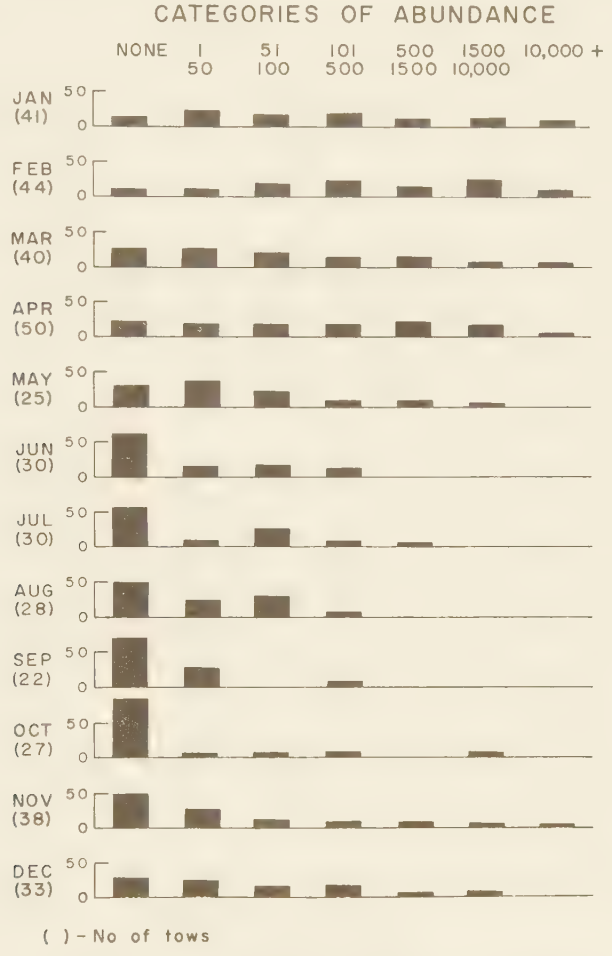

Figure 9.--Percentage occurrence of barnacle nauplii and cyprids in categories of abundance (November 1953 - May 1958).

CUMACEA

These small, shrimp-like crustaceans were found infrequently in the collections in very small numbers and were limited to a 4-month period, late fall to early spring. Their occurrence was as follows:

Month	Year	Number
November	1953	1
November	1955	2
November	1957	2
December	1955	1
January	1957	21-50
January	1958	7
March	1957	21-50

ISOPODA

Isopods never were abundant but were present in most of the plankton net catches. Some were observed to be parasitic on small fish. On several occasions, examination of larval and juvenile fish found dead in aquaria revealed an isopod firmly attached to the gills. This suggests that parasitic isopods may be responsible for numerous fatalities of small fish in the lagoon and similar areas.

AMPHIPODA

Amphipods of the suborders Gammaridae and Caprellidae were of common occurrence. They seldom were abundant and no pattern was evident.

DECAPODA — Shrimp and Crabs

Identification of pre-juvenile forms of many of the shrimps occurring in the Gulf of Mexico is in an uncertain status. Adults of at least four families occur in the lagoon, namely: Penaeidae, Sergestidae, Crangonidae, and Palaemonidae. Unquestionably, the very young of these shrimp also occur in the area. Due to the uncertainty of identification, only those occurrences where positive identifications were made are presented.

Post-larval peneid shrimp were observed in great abundance on March 8 and August 4, 1955; May 14, 1956; and April 25, 1957. They were swimming at the surface and so concentrated that several thousand could be caught with a single scoop of a dip net. On each occasion, large numbers of fish (mostly pinfish and anchovies) could be seen decimating the relatively helpless shrimp. An interesting observation was made during the August occurrence. The post-larval peneids were concentrated in a winding "band", a foot or more in width, that extended from the culverts well out into Bolivar Roads.

Adult and young white shrimp, *Penaeus setiferus* (Linnaeus), were taken from time to time by cast net in area "A", chiefly in the spring and fall. The series of seven seine hauls made there in November 1955 yielded an average of 96 young and adults, ranging in length from 5.0-12.5 cm.

Adult and young of the Sergestid shrimp, *Lucifer faxoni* Borradaile, were taken in small numbers in every month during the period except in December, January, and February.

Crangonidae, or snapping shrimp, were never taken in the plankton catches but were found occasionally under submerged rocks along the margin of the basin during the warmer months. Three adults lived for nearly a year in a 30-gallon aquarium.

Young Palaemonid shrimp appeared infrequently in the plankton collections but were present in abundance along the shores of the lagoon except during severe cold weather. These hardy grass shrimp thrive well in aquaria. Although a large number of females with eggs were held for a long as 6 months, none were ever observed to spawn.

PORCELLANIDAE — Porcelain Crabs

Zoeae of porcelain crabs occurred occasionally in the plankton collections, usually with large numbers of zoeae and/or megalopa of *Callinectes sapidus* Rathbun. Except for one occasion, July 22, 1954, when over 500 specimens were present, these unusual zoeae occurred as individual specimens or in very small numbers.

PAGURIDAE — Hermit Crabs

Megalopa of the hermit crab were found infrequently, varying in number from 1 to 15 specimens. None appeared in collections made in February, March, or December of any year and were observed only during November in 1956 and October in 1957.

PORTUNIDAE — Swimming Crabs

Zoeae and megalopa of swimming crabs occurred in varying abundance throughout the period as shown in figure 10. Adults of the common blue crab, *Callinectes sapidus*, are year-round inhabitants of the lagoon and are particularly abundant during the summer months. On numerous occasions, zoeae and megalopa were held through the juvenile stage in small aquaria. In each instance they proved to be *C. sapidus*, and evidently this commercially important species comprises a large percentage of the early stages of swimming crabs presented in figure 10, especially those that occurred from June to October. *C. danae* Smith, a closely related species, is known to occur in the area but was not identified in any of the samples.

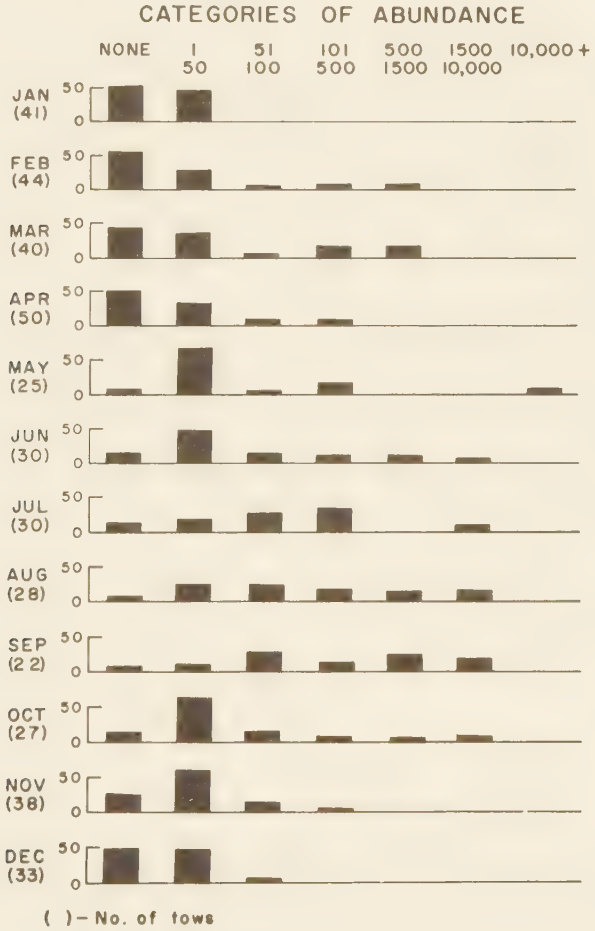

Figure 10.--Percentage occurrence of crab zoeae and megalopa in categories of abundance (November 1953 - May 1958).

OCYPODIDAE — Fiddler Crabs

Fiddler crabs (*Uca pugnax* S. I. Smith) were moderately abundant along the shore of area "A" as well as the rest of the lagoon and provided an excellent source of bait for those anglers addicted to sheepshead fishing.

GRAPSIDAE

This family is represented by one species, *Sesarma reticulatum* Say, which was found in close association with fiddler crabs along the lagoon shores but in much less abundance.

STOMATOPODA

SQUILLIDAE — Mantis Shrimp

Larvae of mantis shrimp, varying in number from 1 to 20 specimens, occasionally appeared in the plankton catches, chiefly in the warmer months.

MOLLUSCA

PELECYPODA — Bivalve Mollusks

Tiny bivalves, approximately 1.5 mm. in diameter, were present in only 10 of the plankton collections over the entire period. Several thousand appeared in the catch made on November 18, 1955, but the average number observed was between 50 and 100 specimens. More than 90 percent of the pelecypods were taken in the months of April, May, October, and November.

GASTROPODA — Snails

Veligers, and gastropods with recently formed shells (1-3 mm. in diameter), occurred in small numbers (usually less than 50) in about 5 percent of the plankton catches. All were taken in the months April through October.

Periwinkles (Littorinidae) and dog whelks (Thaisidae) were very abundant on the rocks around the basin. On one occasion, over 600 specimens of the latter were collected in less than an hour.

A small nudibranch of sea slug, approximately 1 cm. in length, was found in the collection made January 28, 1955, and is our only record of this order.

CEPHALOPODA

LOLIGINIDAE — Squids

Juvenile squid, 4 to 15 mm. in length, occurred sporadically in the plankton catches, one in June and one in December 1954; one in March 1955; nine in April and eight in October 1956. Thirty-three young squid, 3 to 6.5 cm. in length, were taken in the series of beach-seine hauls made in area "A" in November 1955.

ECHINODERMA

Echinoderm larvae are another example of planktonic forms that appeared sporadically in the collections and in very small numbers. A few specimens were observed on six occasions, all in the warmer months.

SUMMARY

From the foregoing catch records and observations it is evident that East Lagoon is utilized as a nursery area by numerous species of fish and invertebrates, some of which are of considerable importance to angling and commercial fishing. A number of fish families, notably: Sparidae, Sciaenidae, Engraulidae, Atherinidae, Mugilidae, Ephippidae, and Pleuronectidae occur not only in immature stages but may be found as adults throughout the year. Table 6 summarizes the occurrence of these and other fishes captured or observed during the course of study.

Table 6.--Occurrence of various fishes (and turtle) captured or observed, November 1953-May 1958

Name	Immature forms	Adults
Loggerhead turtle	none	single capture, Aug. 1957
Alligator gar	none	single capture, May 1958
Gafftopsail catfish	none	infrequently-warmer months
Hardhead catfish	none	common-May-Oct. Occasionally rest of year
Spotted snake eel	none	capture records confined to Oct. 1955
Speckled worm eel	winter months	none
Ocellated moray	none	single capture, Oct. 1955
Tenpounder	March-mid-May	none
Gizzard shad	none	sporadic
Big-Eyed sardine	May-Nov.	none
Thread herring	single juvenile, Dec. 1957	none
Gulf menhaden	mid-Nov.-May	none
Bay anchovy	mostly late fall-early spring	all year, but very few late summer-early fall
Striped anchovy	none	sporadic - 4 occasions - March, Sept., Nov., Jan.
Lizardfish	spring	warmer months
Killifishes	spring	all year
Sailfin molly	none	warmer months
Needlefish	none	warmer months
Pipefish	early spring	none
Silversides	fall	all year, most abundant in summer
Striped mullet	mid-Nov. to mid-Feb.	all year
Eight-Fingered threadfin	none	2 capture records-April 1956
Cutlass fish	none	all year, most abundant in warmer months
Common jack	warmer months	warmer months, mostly summer
Bumper	warmer months	warmer months, mostly summer
Lookdown	none	single capture, Nov. 1955
Common pompano	late spring-early fall	summer and fall
Leatherjacket	summer	late summer and fall
Bluefish	none	late spring and summer

Table 6.--Occurrence of various fishes (and turtle) captured or observed, November 1953-May 1958 (cont'd.)

Name	Immature forms	Adults
Dolphin	single capture, May 1958	none
Spot snapper	none	occasionally - fall
Pigfish	none	sporadic - spring
Pinfish	winter-midspring	all year
Sheepshead	none recognized	all year
Mojarra	late spring-midsummer	summer - late fall
Sciaenids (see discussion)	late fall-midspring	all year
Spadefish	mid-May - early July	all year, most abundant in June and Oct.
Swellfish	late fall	none
Southern sea robin	one capture record, Nov. 1955	none
Sleeper	none	only found during Oct. 1957
Gobies	none	occasionally, all year
Toadfish	none	all year, most abundant in warmer months
Clingfish	spring	all year
Hairy blenny	infrequently, mostly in spring and summer	one capture record - off jetties in fall
Southern flounder	Feb.-May	all year - abundant Oct. to late Nov.

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